
EXPERIMENT 7
pH of Acid, Base and Salt Solutions
PART I

PURPOSE:

To determine experimentally the pH of several acids, base and salt solutions with the aid of a pH meter and to compare the experimentally determined values with the theoretical, calculated pH values.

PROCEDURE:**I. Calculate the theoretical pH values for the solutions listed below**

Calculate and record the expected pH of each of these solutions by using appropriate equilibrium constants, where appropriate.

Show all your calculations in details and include equilibrium tables, where appropriate.

1.	Hydrochloric acid	HCl(aq)	0.10 M
2.	Acetic acid	HC ₂ H ₃ O ₂ (aq)	0.10 M
3.	Ammonium chloride	NH ₄ Cl(aq)	0.10 M
4.	Sodium acetate	NaC ₂ H ₃ O ₂ (aq)	0.10 M
5.	Aqueous ammonia	NH ₃ (aq)	0.10 M
6.	Sodium hydroxide	NaOH(aq)	0.10 M

II. Determine the required calibration of the pH meter.

- You will need to have available three buffer solutions:
pH = 4.01, pH = 7.01 and pH = 10.01
- You already have stored in your locker 10 mL of two buffer solutions (pH = 7.01 and pH = 4.01) Transfer about 10 mL of a buffer 10.01 solution into a third labeled plastic test tube, by matching the level of the buffer 7.01 or buffer 4.01 (no need to use the graduated cylinder again).
- For the **acidic solutions (pH < 7)** you need to perform a two point calibration, as indicated below:
First with pH = 7.01 Buffer
Next with pH = 4.01 Buffer
This procedure applies to:
- For the **basic solutions (pH > 7)** you need to perform a two point calibration, as indicated below:
First with pH = 7.01 Buffer
Next with pH = 10.01 Buffer

III. Measure and record the pH of each of the six solutions, by using an appropriately calibrated pH meter.

- The solutions are available in the lab either in burets or bottles.
- Dispense 10 mL of each solution into six clean, labeled shell vials.
- Measure the pH of the six solutions and record your data

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IV. Error Analysis

Compare your measured, experimentally determined pH values with the calculated, theoretical values. Calculate the Percent Error in each case and express it to the appropriate number of significant figures.

Recall:

$$\% \text{ Error} = \frac{\text{Experimental Value} - \text{Theoretical Value}}{\text{Theoretical Value}} \times 100$$

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REPORT FORM

NAME: _____ Date: _____ Partner: _____

	Solution tested	CONC.	pH Theoretical (Calculated)	Calibration of pH meter 7/4 OR 7/10	pH Experimental (Measured) Record readings to the nearest 0.01 value.
1	HCl(aq)	0.10 M			
2	HC ₂ H ₃ O ₂ (aq)	0.10 M			
3	NH ₄ Cl(aq)	0.10 M			
4	NaC ₂ H ₃ O ₂ (aq)	0.10 M			
5	NH ₃ (aq)	0.10 M			
6	NaOH(aq)	0.10 M			

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Note: 1. All measured pH values should be recorded to the nearest ± 0.01 pH unit.

2. Use $K_w = 1.00 \times 10^{-14}$

1. 0.10 M HCl

Measured Value:

pH =

% Error:

--

Calculated Value:

pH =

Show calculations below:

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2. 0.10 M HC₂H₃O₂ ($K_a = 1.8 \times 10^{-5}$)

Measured Value:

pH =

% Error:

--

Calculated Value:

pH =

Include Equilibrium Table and show ALL calculations below:

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3. **0.10 M NH₄Cl** (K_b of $\text{NH}_3 = 1.76 \times 10^{-5}$)

Measured Value: pH =

Calculated Value: pH = % Error:

Include Equilibrium Table and show ALL calculations below:

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4. **0.10 M NaC₂H₃O₂** (K_a of HC₂H₃O₂ = 1.8 x 10⁻⁵)

Measured Value:

pH =

% Error:

Calculated Value:

pH =

Include Equilibrium Table and show ALL calculations below:

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5. **0.10 M NH₃** (**K_b = 1.76 x 10⁻⁵**)

Measured Value:

pH =

Calculated Value:

pH =

% Error:

Include Equilibrium Table and show ALL calculations below:

:

6. **0.10 M NaOH**

Measured Value:

pH =

Calculated Value:

pH =

% Error:

Show calculations below: